

**Determination of Occupancy Load**  
**And**  
**Egress Requirements for Basement Meeting Rooms**  
**Greenfield Public Library**  
**420 Main Street**  
**Greenfield, MA**



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## 1. EXECUTIVE SUMMARY

This report is a determination of the occupancy load and egress requirements for the meeting rooms located in the basement addition to the Greenfield Public Library.

Based on the calculated occupancy load, two means of safe egress from the two rooms are required. The exit at the north end of the corridor between the two rooms serves as one means of egress.

The second means of egress from the two rooms is the enclosed stairway that leads to grade at the northern end of the west side of the basement stack area. The stairway is non-code compliant as an egress route. The basement stack room is typically locked shut except during limited times when the stack area is occupied. Consequently, the basement stack room exit cannot be considered a safe means of egress.

The door to the stairway that leads up to the first floor (non-code compliant as an egress route) is also locked when the library is closed.

Egress doors and access routes must be operable at all times that the building is occupied.

The determination herein is that a code compliant second means of egress is not available to the occupants in the basement meeting rooms when used during periods when the library is closed. The basement stack area is also without a code compliant second means of egress. There is no accessible second means of egress available in the basement.

The building official and the fire chief are charged with public safety. They have the authority to require compliance with the building code in cases of insufficient egress.

For the purposes of planning, a two possible ways to create a code compliant and accessible means of egress from the basement areas were developed.

Option 1 (see Appendix A) would create new exit doors at the back of rooms B101 and B102. New retaining walls and accessible ramps would be built to on the eastern and western sides of the addition for egress to safe discharge areas. On the west side, the stack room egress stairs would be eliminated and the exit would discharge to a ramp intersecting with the B101 ramp. The approximate cost for this option would be \$86,000. The additional cost for an engineer or architect to design the modifications would be about \$20,000.

Option 2 (see Appendix B) would create a new exit door on the west side of B101 with a new retaining wall system. The stack room egress stairs would be eliminated and the exit would discharge to a ramp that would intersect with the new ramp system on that side. Egress from B103 would be through a new corridor created by partitioning off the back of room 101 to discharge through the new exit on the west side. The floor area in B101 would be decreased by about 25% due to the corridor. The approximate cost for this option would be \$54,000. The additional cost for an engineer or architect to design the modifications would be about \$14,000.

The costs are approximate. They are based on the author's opinion and conceptual designs. No actual designs exist, therefore the numbers presented are theoretical.

2. APPLICABLE OCCUPANCY LOAD REGULATIONS.

The Massachusetts State Building Code (780 CMR) relative to the occupancy load consists of the International Building Code, the International Existing Building Code, and the Massachusetts Amendments to those codes. The Massachusetts Board of Fire Prevention Regulations (527 CMR) also apply. The relevant sections from the Building Code are listed below:

Chapter 1. Scope and Administration of the Building Code.

Section 102.6 governs existing structures and allows for continued occupancy of a building “without change, except as specifically covered in 780 CMR or as deemed necessary by the building official for the general safety and welfare of the public.”

Section 102.6.4 covers existing means of egress, lighting, and ventilation. It allows the building official to site and order abated several specific conditions, among which are number of means of egress and insufficient width of egress.

Chapter 3. Use and Occupancy Classification.

Section 303.4 lists libraries as Assembly in Group A-3.

Section 304 lists office areas as Business Group B

Chapter 10. Means of Egress.

Section 1004, Occupancy Load. The following is taken from Table 1004.1.2:

Occupancy	Occupant Load Factor (floor area in sq. ft. per occupant)
Assembly w/o fixed seats	7 net
Assembly un-concentrated (tables and chairs)	15 net
Library Reading Rooms	50 net
Library stack Area	100 gross
Business Areas	100 gross
Accessory Storage Areas, Mech. Equip. Rooms	300 gross

Section 1004.3, Posting of Occupancy Load requires that the occupancy load be posted in a conspicuous place in all rooms designated as Assembly.

3. OCCUPANCY LOAD DETERMINATION.

The occupancy load for the basement level of the northern addition that contains the meeting rooms (B101 and B103) and the corridor (B102) were determined separately from the rest of the basement because those rooms are used when the doors to the basement stack room and the stairway to the first floor are locked.

Occupancy Load of the Basement of Northern Addition	
Room	Occupancy Load (number of occupants)
B101 Meeting Room (810 s.f.)	54
B103 Meeting Room (803 s.f.)	54
Total	108

The Occupancy load for the entire basement was calculated to determine the egress requirements for the entire basement.

Basement Occupancy Load	
Room	Occupancy Load (number of occupants)
B107 Basement stack area (2,364 s.f.)	24
B108 Janitor closet (270 s.f.)	1
Mechanical Room (170 s.f.)	1
B101 Meeting Room (810 s.f.)	54
B103 Meeting Room (803 s.f.)	54
Total	134

4. EGRESS REQUIRMENTS.

The following sections from the building code are applicable to the occupancy load and egress requirements for the basement:

Section 1006 relates to the number of exits and exit access doorways.

The number of exits required is determined by Table 1006.2.1. Part of the table is replicated below:

Spaces with One Exit or Exist Access Doorway		
Occupancy	Maximum Occupant Load of Space	Max. Path of Egress Travel Distance (ft.) (without Sprinkler System)
A	49	75
B	49	100

The calculated occupancy load for the basement meeting rooms was 108 persons, which exceeds the one egress criteria of 49 persons. The travel distance from the meeting rooms to the stack room exit is 128 ft. which exceeds the allowable travel distance of 75 ft. for one exit.

Two exits are required for rooms B101 and B103.

The minimum number of exits for each story are listed in Table 1006.3.1:

Occupant Load per Story	Minimum Number of Exits or Access to Exits Per Story
1-500	2
501-1,000	3

Two exits are required from all areas in the basement.

Section 1009, Accessible Means of Egress requires that where more than one means of egress are required, each space shall be served by at least two accessible means of egress. Exception 1 to section 1009.1 states “Accessible means of egress are not required to be provided in existing buildings.” However, the Existing Building Code (sections 401.2, 801.3, and 1401.2) states that all new construction must meet the current building code, which includes compliance with the Massachusetts Access Board regulations. If a new means of egress was created, it would have to

meet the building code, including the accessibility requirements.

The following sections relate to the width of the egress path. The sections have been re-organized to allow for a clear train of reason.

Section 1005, Means of Egress Sizing, the minimum width of each component along the egress path must be determined from the requirements for that component.

Section 1005.3.2, Other Egress Components (than stairways), determines that the capacity of means of egress components be calculated by multiplying the occupancy load by 0.2 in per occupant.  $0.2 \times 134 = 27$  in.

Section 1005.7.1, Doors, when fully opened, doors shall not reduce the required width by more than 7 in.

Section 1020, Corridors, requires that the minimum width of egress corridors is 44 in.

Section 1005.4, Continuity, requires that the minimum width of the egress path is not to be reduced along the path of travel.

Section 1010.1.1, Size of Doors, The required width for exit doors shall be sufficient for the occupancy load and shall provide a minimum clear width of 32 in.

Consequently, where serving the entire basement, the egress route must be at least 44 in. wide. Doors along the path of egress must be at least 37 in. wide (44 in. – 7 in.), including exterior doors. Egress doors from B101 and B103 must meet the minimum 32 in. width.

Section 1016.2, Egress Through Intervening Spaces. Item 3 does not allow for egress passage through spaces that can be locked.

Section 1010.1.9, Door Operations, requires that doors shall be readily openable from the egress side without the use of a key, special knowledge, or effort.

CMR 527, Section 4.4.3.1.1 states “In every occupied building or structure, means of egress from all parts of the building shall be maintained free and unobstructed.”

CMR 527, Section 4.4.3.1.2 states that “No lock or fastening shall be permitted that prevents free escape from the inside of any building other than health care occupancies and correctional occupancies where staff are continuously on duty ... “

Section 1029.7 Travel Distance. The travel distance to an exit door shall not be greater than 200 ft. The 200 ft. distance applies where the egress routes are compliant with the code.

## 5. SUMMARY OF EXISTING CONDITIONS.

Regarding egress from rooms B101 and B103, two code compliant means of egress are required by the building code. A code compliant means of egress would be equipped with proper fire separation from surrounding areas, exit signs, emergency lighting, the correct width along the route, and fire rated exit doors with the appropriate hardware, such as panic bars.

The exit at the north end of the corridor (B102) serves as one means of egress. The doorway is 36 in. wide, which is slightly less than required (37 in.)

The enclosed stairway at the northern end of the west side of the basement stack area is non-compliant and non-available as second means of egress.

The travel distance is about 128 ft. The stack room egress route leads up a set of stairs to an exterior door. The enclosed stairway is not fire rated, the stairs are non-code compliant, the route is not marked as an exit route, and the exit door is barred closed with a 2x4 placed in brackets. The basement stack room is typically locked shut except during limited times when the stack area is occupied. The basement stack room exit cannot be considered a safe means of egress.

The stairway to the first floor (outside of the mechanical room.) is not marked as an egress route from the basement and it is inaccessible. The door leading to the stairwell is locked when the library is closed.

The basement is marked as an accessible entrance into the library by the sign on the exterior wall. As such, it implies that a person entering through that door has the same level of safety as persons that do not require the accessible entrance. If that door is blocked, there is no second accessible means of egress from rooms B101 and B103 at any time, even when the library is open. Essentially, it's a trap. Elevators cannot be considered as a means of egress during a fire.

Egress doors cannot be locked in the direction of the egress route. Typically, areas that are not open to the public or areas where access is limited are provided with hardware that sounds an alarm when opened (and appropriate signage.) The entire egress route must be available at all times that the building is occupied.

The determination herein is that a compliant second means of egress is not available to the occupants in rooms B101 and B103 during times when the library is closed. At no time is there an accessible second means of egress available to occupants in the basement. Also, at no time is there a code compliant second means of egress from the stack area.

The building official and the fire chief have the authority to require compliance with the building code.



## 6. OPTIONS FOR COMPLIANT EGRESS.

Limiting the use of the meeting rooms to periods when the library is open does not resolve the issue of insufficient number of means of egress from rooms B101 and B103. The stack room is often locked when the library is open. Locked or not, the stack room exit door is non-compliant due to the barred doorway, the non-compliant inaccessible stairs, and the lack of emergency exit signage and lighting. The stairway to the second floor is non-compliant due to the lack of exit signs and emergency lighting and it is not accessible.

In order to make the library safe for all patrons, two options were considered. Option 1 provides egress from B101 and B103 to the exterior directly. Option 2 is less expensive. It provides egress from B103 through B101, and reduces the floor area of B101 by about 25%. Both options provide a compliant means of egress from the stack area.

Option 1 (see Appendix A.) Egress from B101 would be provided by creating a new egress door in the existing foundation wall at the southwest corner of the room. A system of retaining walls, sidewalks, and ramps would be constructed to run parallel to the western wall and to discharge to the existing sidewalk. The stack room egress would be made code compliant by removing the existing stair enclosure and creating an at-grade egress route by extending the new retaining wall to the stack room foundation wall. The stack room floor is 14 in. above the meeting room floor, so a 14 ft. ramp would be necessary leading from the stack room door down to the new sidewalk. A set of stairs would need to be built to allow egress from the second floor fire escape to grade. Egress from B103 would be from a new exit door cut into the existing foundation wall at the southeast corner of the room. A system of retaining walls, sidewalks, and ramps would be constructed to discharge to the existing sidewalk.

Option 2 (see Appendix B.) Egress from B103 would be provided by creating a fire rated partition wall in room B101 to serve as an egress corridor. A new exit doorway would be cut into the existing foundation wall at the southwestern corner of room B101. The interior doors from B101 and B103 would be reconfigured to discharge into the new corridor. The stack room egress would be made code compliant by removing the existing stair enclosure and creating an at-grade egress route by extending the new retaining wall to the stack room foundation wall. A 14 ft. ramp would be necessary leading from the stack room door down to the new sidewalk. A set of stairs would be built to allow egress from the second floor fire escape to grade. All doors would be fire-rated and fitted with the appropriate hardware. Exit signs and lighting would be installed. Ramps would be fitted with guardrails and handrails.

Option 3. Do nothing. There is no requirement to upgrade a building to meet the current building code unless the owner is notified by the building inspector or fire chief that the building must be made to comply with the building code if an unsafe condition exists. However, there is a certain degree of liability assumed when an owner is made aware of unsafe conditions and chooses not to address them. In the panic of an emergency, locked egress doors and inaccessible egress routes could result in a disaster. In that case, the public would be seeking answers as to why the unsafe conditions were permitted to remain.

## 7. COST OPINION.

A cost opinion is herein provided for the two options described above. The cost opinion is for planning purposes only. The cost opinion is an educated guess of a conceptual design and may vary from actual costs by as much as 100% or more.

### Option 1.

1. New door opening in the B101 west exterior wall with a fire rated door, frame and hardware.
2. New door opening in the B103 east exterior wall with a fire rated door, frame and hardware.
3. New exit door from stack area with a fire rated door, frame and hardware.
4. Exit signs and lighting.
5. West side: two retaining walls, one with steps to the fire escape from the second floor.
6. West side: concrete sidewalk with ramps, landings, guardrails, and handrails extending to the existing sidewalk.
7. East side: two concrete retaining walls.
8. East side: concrete sidewalk with ramps, landings, guardrails, and handrails extending to the existing sidewalk.

The cost for the above would range from \$76,000 to \$95,000. Engineering or architect fee for design for basement egress project may range from \$16,000 to \$24,000.

### Option 2.

1. New door opening in the B101 exterior wall with fire rated door, frame and hardware.
2. Exit signs and lighting.
3. Relocate B103 doorway.
4. New fire rated corridor wall in B101.
5. West side: two retaining walls, one with steps to the second floor fire escape.
6. West side: concrete sidewalk with ramps, landings, guardrails, and handrails extending to the existing sidewalk.
7. New exit door from stack area with a fire rated door, frame and hardware.

The cost for the above would range from \$48,000 to \$60,000. Engineering or architect fee for design for basement egress project may range from \$10,000 to \$18,000.

## 8. SUMMARY.

The occupancy load was determined for the two meeting rooms in the basement. It was determined that two means of egress are required from each of the meeting rooms. Based on the occupancy of the basement, it was determined that two means of egress are required from all areas of the basement at all times that the library is occupied. It was also determined that all new work is required to meet the building code and the Architectural Access Board Regulations.

The door at the northern end of the basement addition is compliant.

The existing alternate routes do not meet the requirements for egress routes. There is no code compliant means to exit from the basement if the northern doorway is blocked. There is no other code-compliant accessible means of egress from the basement at any time.

At all times when the library is open, it is required that there are two accessible routes to an exit from any area in the basement, including the basement stack area.

Based on the two options provided, the cost of providing code compliant egress routes would range from about \$68,000 to \$106,000 depending on the option selected.

End of Report

Michael Rainville, P.E.

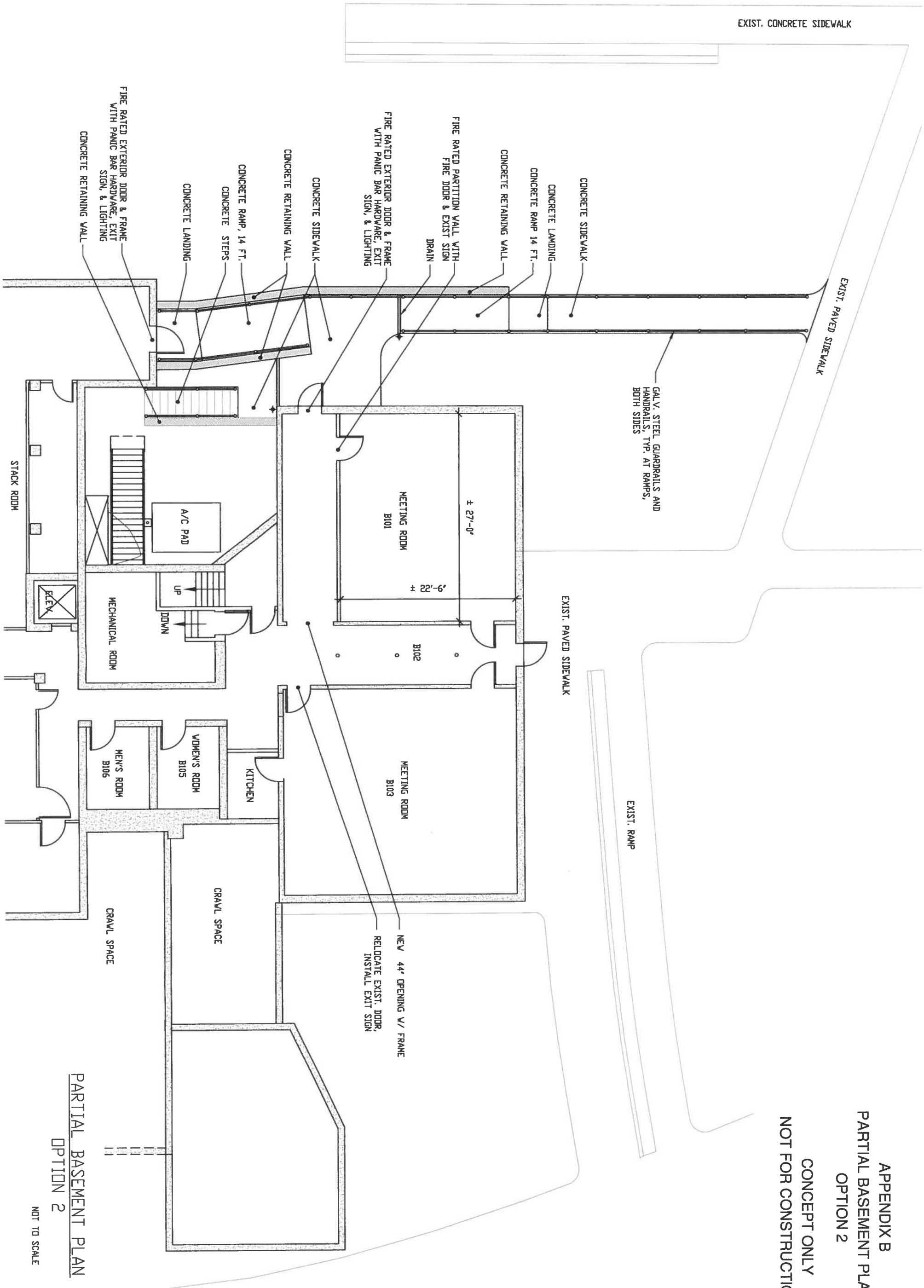
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APPENDIX B  
PARTIAL BASEMENT PLAN  
OPTION 2

CONCEPT ONLY  
NOT FOR CONSTRUCTION



PARTIAL BASEMENT PLAN  
OPTION 2

NOT TO SCALE

## APPENDIX A AL BASEMENT OPTION 1

CONCEPT ONLY  
NOT FOR CONSTRUCTION

